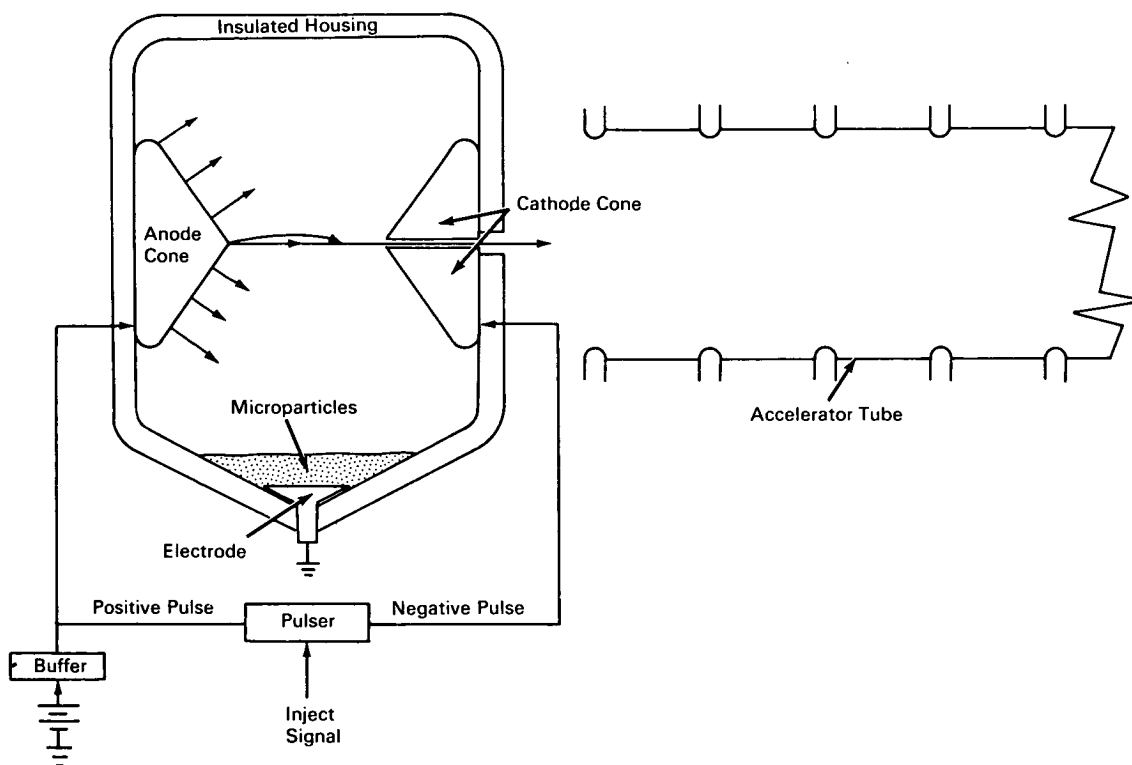


# NASA TECH BRIEF



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## Dust Particle Injector for Hypervelocity Accelerators Provides High Charge-to-Mass Ratio



### The problem:

To design a device that will impart a high charge-to-mass ratio to microparticles and inject them into an electrostatic accelerator so that the particles will be accelerated to meteoric speeds. Existing microparticle injectors provide only approximately one-tenth the required charge-to-mass ratio, incorporate a fragile charging electrode, and do not control the injection

angle. The accelerated particles are to be used for calibration of micrometeoroid impact sensors and studies of erosion and luminous effects.

### The solution:

An injector that employs relatively large masses in the anode and cathode structures with a relatively wide separation. This construction permits a large increase in the allowable injection voltages.

(continued overleaf)

**How it's done:**

Microparticles from the supply hopper are electrostatically agitated when a positive high-voltage injection pulse appears on the anode cone. When this pulse is removed, agitated microparticles are attracted and attached to the surrounding surfaces inside the housing by electrostatic attraction and by Van der Waals polarization forces. Many of these particles adhere to the anode, which normally remains at a low positive potential.

Particle injection into the accelerator tube occurs when an inject signal appears in the pulser unit. At this time, a positive high-voltage pulse appears on the anode simultaneously with a negative high-voltage pulse on the cathode cone. Particles attached to the anode are repelled in a direction perpendicular to the segment of surface upon which they were attached and are accelerated and focused by the electric field between the anode and cathode cones. The strongest field exists in the region of the axis between the two cones. Particles in or near this region are collimated into the axial opening in the cathode cone and pass into the accelerator tube.

The particles attached close to the apex of the anode surface will acquire a higher positive charge than those attached to other portions of the anode, since the charge is proportional to the ratio of the radius of a particle to the radius at any given cross section of the cone. These particles will therefore be more strongly collimated into the cathode opening than other particles, which will either fall back into the supply hopper or be suspended elsewhere to await another electrostatic agitation.

**Note:**

Inquiries concerning this invention may be directed to:

Technology Utilization Officer  
Goddard Space Flight Center  
Greenbelt, Maryland 20771  
Reference: B66-10347

**Patent status:**

Inquiries about obtaining rights for the commercial use of this invention may be made to NASA, Code GP, Washington, D.C. 20546.

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